Appendix F: Station Status Broadcasts

1. Introduction

The Automated Tracking Software (ATS) is a multi-process Windows NT software system that contains several core applications. One of these applications is *MonitorAndControl.exe (M&C*) located under the folder *c:\Master* on any EPGN Master PC. This application is responsible for receiving equipment status collected on a Master and sending it to remote clients using a TCP/IP socket connection on the Control and Status sub-network maintained by Goddard Space Flight Center (GSFC). The status is sent to remote clients using the *StationStatusMonitor* thread executing under *M&C*. Successful startup of this thread at support initialization times is required to fulfill *Reporting Master* responsibilities.

These status messages can be displayed using the ATS utility *StationStatusDisplay.exe* (SSD) also located under the folder *c:\Master*. Status can also be processed on the remote client end using any other software application that can connect to the master executing SSB and read and decode the series of messages.

All station status messages are formatted with respect to the byte order used on Intel PC platforms. No byte-swapping to accommodate processing and display on remote clients with other operating systems is done.

2. Operational Design

The *MonitorAndControl.exe* core process on the EPGN Master collects and displays status from all ATS-configurable devices. An M&C threaded function, *StationStatusMonitor (SSM)*, relays the status to remote clients identified in the support profile using TCP/IP socket connections. The following sequence of operator and ATS actions will initiate the socket connections and start the transmission of status messages:

(1) Remote client operators start their software and begin "listening" for a remote TCP/IP socket from the *StationStatusMonitor* thread executing in *MonitorAndControl*. The remote client software must be executing prior to support initialization.

(2) At support initialization time (typically AOS – 10 minutes), the *StationStatusMonitor* thread reads IP addresses and port numbers from an operator-defined list contained in the support or operational profile.
(3) *SSM* begins sending a *heartbeat* message from an EPGN Master to remote clients. The format of the heartbeat message, as well as other messages, is described below in **3. Status Broadcast Message Format**. This *heartbeat* message verifies the communication integrity between the Master and remote client.
(4) At support *Initialization*, typically ten minutes prior to AOS, *SSM* is started in M&C. *SSM* formats the status and relays it to the remote clients identified in the profile. This status relays occurs between the *Initialization* and *Takedown* phases of the ATS automation cycle. The *StationStatusMonitor* thread terminates and this and the TCP/IP sockets are closed at *Takedown.*. See **Figure 1** for the general design of the *StationStatusBroadcaster.exe* application.

3. Status Broadcast Message Format

The *StationStatusBroadcast* application fills a data structure with three 4-byte integers and a character string that will never exceed 600 bytes. The following C data structure describes the format of the status message:

```
struct StatusData {
    int iSite;   // site ID
    int iType; // message type
```

```
    int iSize;  // message size
   char sStatus[600]; // message body
}; // 612-byte structure

StatusData statusdata; // declare statusdata of type StatusData
```

The **site ID** is sent as a 4-byte integer. The following table defines the values that may be sent for the site ID and their corresponding sites.

ID	site
0	AGS
1	MGS
2	SGS
3	WGS

Note: Execution of the SSB process on each reporting EPGN Master can be achieved. Remote client display applications should be developed to accommodate this possibility.

The **message type** is also transmitted as a 4-byte integer value. The following table defines the values that may be sent for the message type and their corresponding descriptions. The **message type** value and the contents of the **message body** are directly related. The contents of each **message type** are discussed in **4. Status Broadcast Message Contents**.

Type	Description
0	Heartbeat
1	Initialization
2	Status
3	Schedule
4	Takedown

The **message size** is an integer value that indicates the size of the status message being transmitted. This value is the byte sum of the three 4-byte integers and the variable length character string status **message body**. The following line of C source code fills the data structure **message size** *iSize* data member:

```
statusdata.iSize = strlen(statusdata.sStatus) + 12;
```

The **message body** is a variable length character string that will never exceed 600 bytes. Contents of the **message body** are discussed in **4. Status Broadcast Message Contents**.

4. Status Broadcast Message Contents

Heartbeat (message type = 0) status messages are transmitted upon successful startup of *StationStatusBroadcaster.exe* on the Master PC. Successful startup of this process will begin filling the status data structure with the three 4-byte fixed words and time as reported on the Master since equipment status monitoring is active only between the *Initialization* and *Takedown* phases of the automation cycle. The heartbeat status messages are transmitted continuously until the operator terminates SSB. The following section of C source code prepares the data structure:

```
long lTime; // time (seconds since 1/1/1970)

// nameStation defined in StationAssets…
        if(nameStation[0] == 'A') stationstatus.iSite = 0;
        if(nameStation[0] == 'M') stationstatus.iSite = 1;
```

```
if(nameStation[0] == 'S')  stationstatus.iSite = 2;
if(nameStation[0] == 'W') stationstatus.iSite = 3;

heartbeatstatus.iType = 0; // heartbeat

while (TRUE)
{
  time(&lTimeNow);

    sprintf(stationstatus.sStatus,"%ld",lTimeNow);
    heartbeatstatus.iSize = strlen(stationstatus.sStatus) + 12;

    for (iLoopSockets = 0; iLoopSockets < iNumClientSockets; iLoopSockets++)
    { // send to number of user-defined remote clients ….
      send(sockClients[iLoopSockets], (const char*)&stationstatus, stationstatus.iSize, 0);
    }  // End for.
}  // End while.
```

Since a typical reported time value is nine characters long, "922831296" for March 30, 1999 at 22:03:00 GMT for instance, the heartbeat message should be 21 bytes long (12 fixed bytes + 9 status).

The **Initialization** message consists of the standard 12 fixed bytes, as well as the variable length ATS satellite operational profile name loaded during the support. Only one **Initialization** message is sent per support. It marks the beginning of the automation cycle when profile-requested devices are requested for assignment. **Initialization** of the QuikSCAT profile, "QST_ 03_30_1999_21_26_29_00" for instance, will force SSB to transmit 12 + 27 = 39 bytes in order to accommodate the profile name in the status word.

Note: Operational support profiles are named using the following convention, SatNam_MO_DA_YYYY_HH_MM_SS_AN.

where,
SatNam = WOTIS satellite Identifier (QuikSCAT designated as "QST")
MO = 2-digit month
DA = 2-digit day-of-month
YYYY = 4-digit year
HH = 2-digit hour (GMT)
MM = 2-digit minute
SS = 2-digit second
AN = 2-digit receive antenna (11, for the 11-meter antenna)

The **status** message consists of a character string that includes a representative label and value for the equipment type and unit monitored for station broadcasting purposes. **A status message will contain information for only one instrument. The concatenation of all EPGN instrument status into one character string is no longer supported in SSB**. If no status is available for a monitored unit, no status for that unit is included in the string. The following table defines the labels and values that may be included in the string. In cases where more than one unit of a type of equipment is monitored, the unit number is appended to the label.

Label	Status Description	Format
"XAGC"	SCC X-Band Signal Strengths	"aa.a (dB) bb.b (dB) cc.c (dB) dd.d (dB)" (where a, b, c and d are channels 1-4, respectively)
"XRcvAGC"	SCC X-Band Tracking Receiver Sig.Strength	"ss (dB)"
"XDemod1"	SCC X-Band (SA924) Demodulator Status (unit 1)	"0" (UNLOCK) or "1" (LOCK)

"XDemod2"	SCC X-Band (SA924) Demodulator Status (unit 2)	"0" (UNLOCK) or "1" (LOCK)
"XDemod3"	SCC X-Band (SA924) Demodulator Status (unit 3)	"0" (UNLOCK) or "1" (LOCK)
"XDemod4"	SCC X-Band (SA924) Demodulator Status (unit 4)	"0" (UNLOCK) or "1" (LOCK)
"XBitSync1"	SCC X-Band (SA924) Bit Sync Status (unit 1)	"0" (UNLOCK) or "1" (LOCK)
"XBitSync2"	SCC X-Band (SA924) Bit Sync Status (unit 2)	"0" (UNLOCK) or "1" (LOCK)
"XBitSync3"	SCC X-Band (SA924) Bit Sync Status (unit 3)	"0" (UNLOCK) or "1" (LOCK)
"XBitSync4"	SCC X-Band (SA924) Bit Sync Status (unit 4)	"0" (UNLOCK) or "1" (LOCK)

"SRcvAGC1"	SCC S-Band Receiver LHC Data Signal Strength	"ss (dB)"
"SRcvAGC2"	SCC S-Band Receiver RHC Data Signal Strength	"ss (dB)"
"SRcvAGC3"	SCC S-Band Receiver LHC Tracking Signal Strength	"ss (dB)"
"SRcvAGC4"	SCC S-Band Receiver RHC Tracking Signal Strength	"ss (dB)"

"SBitSync1"	ATS Decom7715 Bit Sync (unit 1) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync2"	ATS Decom7715 Bit Sync (unit 2) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync3"	ATS Decom7715 Bit Sync (unit 3) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync4"	ATS Decom7715 Bit Sync (unit 4) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync5"	ATS Decom7715 Bit Sync (unit 5) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync6"	ATS Decom7715 Bit Sync (unit 6) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync7"	ATS Decom7715 Bit Sync (unit 7) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync8"	ATS Decom7715 Bit Sync (unit 8) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync9'	ATS Decom7715 Bit Sync (unit 9) status	"0" (UNLOCK) or "1" (LOCK)
"SBitSync10"	ATS Decom7715 Bit Sync (unit 10) status	"0" (UNLOCK) or "1" (LOCK)

Label	Status Description	Format
"SFrmSync1"	ATS GDP225 Frame Sync (unit 1) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync2"	ATS GDP225 Frame Sync (unit 2) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync3"	ATS GDP225 Frame Sync (unit 3) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync4"	ATS GDP225 Frame Sync (unit 4) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync5"	ATS GDP225 Frame Sync (unit 5) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync6"	ATS GDP225 Frame Sync (unit 6) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync7"	ATS GDP225 Frame Sync (unit 7) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync8"	ATS GDP225 Frame Sync (unit 8) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync9"	ATS GDP225 Frame Sync (unit 9) status	"0" (UNLOCK) or "1" (LOCK)
"SFrmSync10"	ATS GDP225 Frame Sync (unit 10) status	"0" (UNLOCK) or "1" (LOCK)

"BVLDS1"	ATS Metrum Recorder (unit 1) status	"SomeState-Address=Block#"
"BVLDS2'	ATS Metrum Recorder (unit 2) status	"SomeState-Address=Block#"
"BVLDS3"	ATS Metrum Recorder (unit 3) status	"SomeState-Address=Block#"
"BVLDS4"	ATS Metrum Recorder (unit 4) status	"SomeState-Address=Block#"
"BVLDS5"	ATS Metrum Recorder (unit 5) status	"SomeState-Address=Block#"
"BVLDS6"	ATS Metrum Recorder (unit 6) status	"SomeState-Address=Block#"
		(for instance, "Recording-Address=12345")

"PTP1"	ATS Programmable Telemetry Processor (unit 1) status	"stream 1, stream 2, … stream n"
"PTP2"	ATS Programmable Telemetry Processor (unit 2) status	"stream 1, stream 2, … stream n"
"PTP3"	ATS Programmable Telemetry Processor (unit 3) status	"stream 1, stream 2, … stream n"
"PTP4"	ATS Programmable Telemetry Processor (unit 4) status	"stream 1, stream 2, … stream n"
"PTP5"	ATS Programmable Telemetry Processor (unit 5) status	"stream 1, stream 2, … stream n"
"PTP6"	ATS Programmable Telemetry Processor (unit 6) status	"stream 1, stream 2, … stream n"
		(where n = number of streams loaded in PTP desktop)

"AZ-Mode="	SCC antenna control unit azimuth angle processor mode	"OFF" or "ON" or "ENABLE"
"EL-Mode="	SCC antenna control unit elevation angle processor mode	"OFF" or "ON" or "ENABLE"

"AZ="	SCC antenna control unit azimuth angle (degrees)	"123.456"
"EL="	SCC antenna control unit elevation angle (degrees)	"123.456"

"ExcMode"	SCC exciter mode	"NOT_ACTIVE" or "SWEEPING" or "LOCK"
"ExcRcvCoh"	SCC exciter coherency	"modulation=32dB" or "modulation<32dB")

"EOS-SS"	SCC EOS channel signal strengths	"aa.a bb.b" (where a and b are channels 1 and 2, respectively)

"REC#1"	SCC X-Band recorder (unit 1)	"state frameID tapeID loaded? Tape% GMT"
"REC#2"	SCC X-Band recorder (unit 2)	"state frameID tapeID loaded? Tape% GMT"
"REC#3"	SCC X-Band recorder (unit 3)	"state frameID tapeID loaded? Tape% GMT"
"REC#4"	SCC X-Band recorder (unit 4)	"state frameID tapeID loaded? Tape% GMT"
"REC#5"	SCC X-Band recorder (unit 5)	"state frameID tapeID loaded? Tape% GMT"
"REC#6"	SCC X-Band recorder (unit 6)	"state frameID tapeID loaded? Tape% GMT"

where,

state = "PLAY, "REVERSE_PLAY", "RECORD", "STOP", "FAST_FORWARD", "REWIND", "SEARCH", "UNKNOWN", or "OFF_LINE"

frameID = tape frame ID number

tapeID = 10-character tape name

loaded? = tape loaded state ("UNLOADED" or "LOADED")

Tape% = "TapeUse=%"; where % = percentage (of tape used * 100)

GMT = "day-of-year hour:minute:second"; "089 23:59:59.123", for instance.

Label	Status Description	Format
"SbandDataCombiner"	SCC S-Band Data Combiner	"UNLOCK or LOCK" for Carrier Detect, PM Demod, and BPSK Demod
"SbandTrackCombiner"	SCC S-Band Track Combiner	"UNLOCK or LOCK" for Carrier Detect, PM Demod, and BPSK Demod

A **Schedule** type messages is transmitted at each phase of the automation cycle in order to update the current status of the support. **Schedule** messages contain the details of the operational schedule window displayed on the EPGN Master PC. Typical **Schedule** status messages include :

"Track LS7 02150 (115) 04/29/1999 14:15:04 TR1 SUP 11-11 023 (115) 04/29/1999 14:25:00 04/29/1999 14:35:00 Waiting"

and,

"Record LS7 02150 AMPEX #1 X1 REC (115) 04/29/1999 14:26:30 04/29/1999 14:30:45"

where,

"Track" and "Record" = scheduled task type;

"LS7 02150" = WOTIS scheduled satellite ID and orbit number;

"(115) 04/29/1999 14:15:04" = Support ***Initialization*** time including (day-of-year)
"TR1 SUP 11-11 023" = TR code, schedule mode, receive-transmit antennas and SCC configuration number;

"(115) 04/29/1999 14:25:00 04/29/1999 14:35:00" = Support AOS and LOS, respectively; including (day-of-year);

"Waiting" = support state; other states include "Initialized", "Setup", "Start", "Stop", "Takedown" and "Complete";

" AMPEX #1 X1 REC" = X-band recorder type and number, scheduled X-band event and REC mode, respectively;

"(115) 04/29/1999 14:26:30 04/29/1999 14:30:45" = X-band recorder start and stop times, respectively, including (day-of-year).

The **Takedown** message marks the end of the automation cycle and device status polling. The following 33-byte character string message is transmitted at **Takedown**:

"Support status monitor completed."

A 180 second sleep is introduced into the *StationStatusMonitor* thread after transmission of the **Takedown** message by SSB in order to respect ATS time delays to reset all equipment, compile post-pass summary reports and prepare for the next upcoming support. At sleep end, another **Schedule** message type is transmitted to the remote clients in order to update upcoming events.

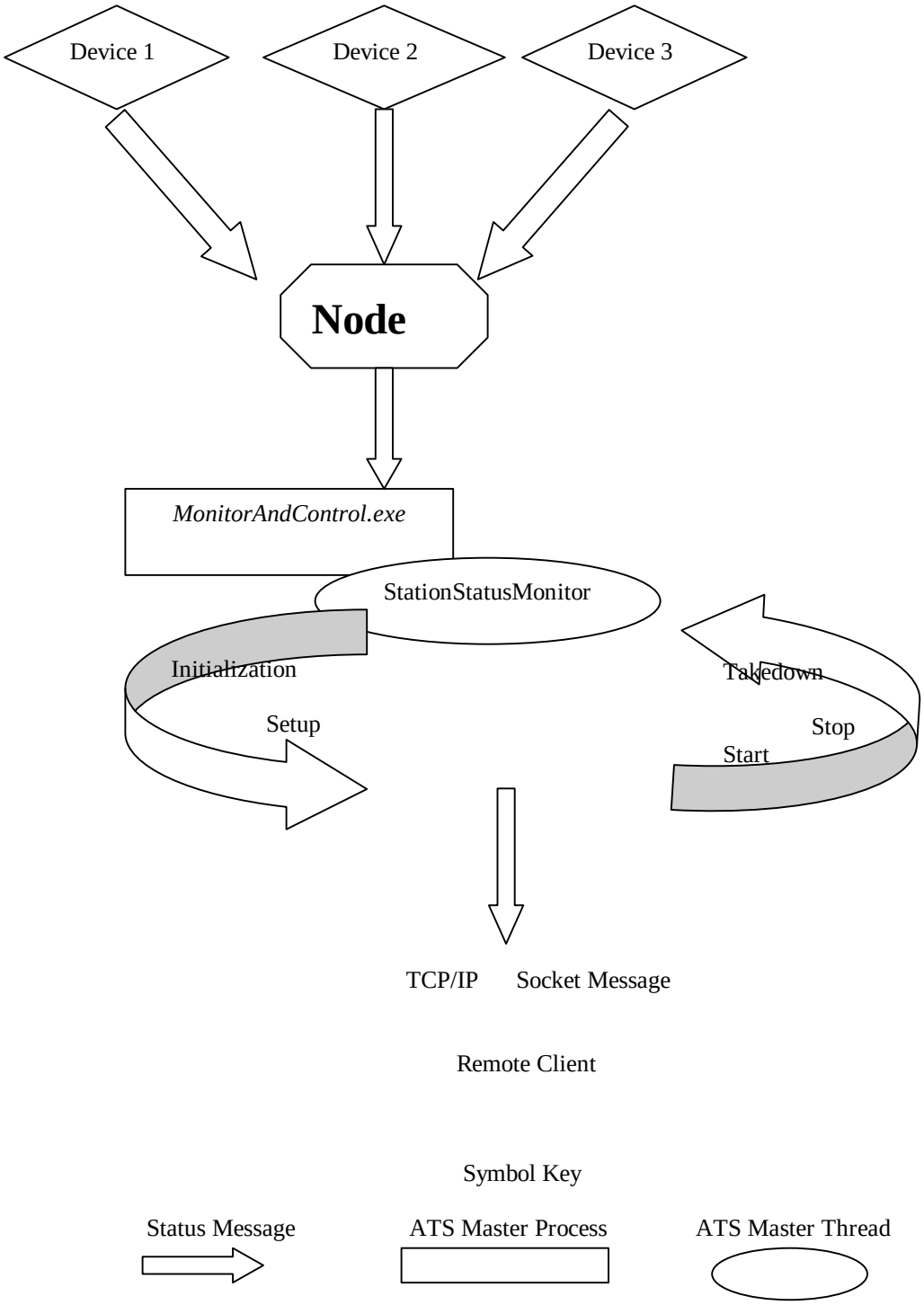

Figure F-1: Station Status Broadcaster General Design